

CLAIMS:

1. A liquid mixing valve, said mixing valve including a first inlet for receiving heated water from a water heater, a second inlet for receiving non-heated water from a water supply, a mixing chamber for mixing water from said first and second inlets and a discharge outlet for discharge of said mixed water from said mixing chamber, a first thermostatic element being disposed within said mixing chamber for controlling the proportions of heated and non-heated water that are mixed within said mixing chamber so that the temperature of the mixed water which is discharged from said mixing chamber does not exceed a predetermined upper temperature and whereby, upon increase of the temperature of the mixed water in the mixing chamber above the predetermined upper temperature, the first thermostatic valve is operable to substantially terminate the flow of water through said discharge outlet, said liquid mixing valve further including a safety valve which includes an inlet in communication with said discharge outlet, an outlet, and a flow passage for liquid therebetween, a second thermostatic element disposed in the flow passage and reactable to expand or contract relative to the temperature of liquid flowing past it, a shut off device which is movable with expansion or contraction of the second thermostatic element, the second thermostatic element being operable to shift the shut off device to a shut off position to substantially terminate flow of liquid through the outlet of the safety valve upon failure of the first thermostatic element to substantially terminate flow of water through the discharge outlet when the temperature of the water in the mixing chamber exceeds the predetermined temperature.
2. A liquid mixing valve according to claim 1, said flow passage extending axially between said inlet and said outlet.
3. A liquid mixing valve according to claim 2, said flow passage being circular in cross-section.
4. A liquid mixing valve according to claim 3, wherein the diameter of said flow passage changes through the length of said flow passage.

5. A liquid mixing valve according to any one of claims 1 to 4, said shut off device including a piston which is positioned in proximity of an opening of said flow passage, for movement toward and away from said opening.

5 6. A liquid mixing valve according to claim 5, said piston being arranged to closely approach said opening.

7. A liquid mixing valve according to claim 5, wherein said opening has a valve seat formed about it and said piston can move into engagement with said 10 valve seat to close said opening.

8. A liquid mixing valve according to any one of claims 5 to 7, wherein said piston is generally cylindrical and includes a conical or frustoconical axial end portion in facing relationship with said opening.

15 9. A liquid mixing valve according to any one of claims 1 to 4, said shut off device including a piston which is circular in cross-section and is arranged for receipt within a circular opening formed in said flow passage, said circular opening having a slightly greater diameter than the external diameter of said 20 piston so that said piston can enter said opening to restrict flow of water through said opening without fully closing said opening.

10. A liquid mixing valve according to claim 9, wherein said piston includes a frustoconical axial end portion in facing relationship with said opening.

25 11. A liquid mixing valve according to any one of claims 1 to 4, said shut off device including a piston which is positioned in proximity to an opening formed in said flow passage, said piston being arranged for movement across said opening to restrict flow of water through said opening.

30 12. A liquid mixing valve according to any one of claims 1 to 11, wherein when said shut off device has moved to substantially restrict flow of liquid through said outlet of said safety valve, said shut off device allows a small amount of liquid to continue to flow past said thermostatic element.

13. A liquid mixing valve according to any one of claims 1 to 4, wherein said shut off device includes a piston and biasing means to bias said piston to a position allowing generally unrestricted flow of liquid through said safety valve.

5

14. A liquid mixing valve according to any one of claims 1 to 4, wherein said shut off device includes a piston which is positioned so that flow of liquid through said flow passage acts on said piston in a direction tending to shift said piston to a position allowing generally unrestricted flow of liquid through said safety valve.

10

15. A liquid mixing valve according to any one of claims 1 to 4, wherein said shut off device includes a piston which is positioned so that flow of liquid through said flow passage acts on said piston in a first direction tending to shift said piston to a position to substantially restrict flow of liquid through said flow passage, and biasing means are provided to bias said piston in a second and reverse direction.

15

16. A liquid mixing valve according to claim 15, said biasing means being a coil spring mounted in compression to act on said piston.

20

17. A liquid mixing valve according to any one of claims 1 to 4, said second thermostatic element including an outer casing, a thermally reactive material within said casing, and a plunger, the plunger being movable upon expansion or contraction of said thermally reactive material, said shut off device including a piston and said plunger being in engagement with said piston to shift said piston upon expansion or contraction of said thermally reactive material.

25

18. A liquid mixing valve according to claim 17, said engagement being fixed engagement.

30

19. A liquid mixing valve according to claim 17, said engagement being abutting engagement.

20. A liquid mixing valve according to any one of claims 17 to 19, said casing being fixed against movement within said flow passage.

21. A liquid mixing valve according to any one of claims 1 to 20 said mixing valve being elongate and defining an axial flow passage between one of said first and second inlets, said discharge outlet, said inlet of said safety valve and said outlet of said safety valve.

22. A water delivery system, including a water supply, a water heater and a liquid mixing valve, said water heater including a tank having an inlet for receiving water from said water supply and an outlet for discharge of heated water, said liquid mixing valve including a first inlet for receiving heated water from a water heater, a second inlet for receiving non-heated water from a water supply, a mixing chamber for mixing water from said first and second inlets and a discharge outlet for discharge of said mixed water from said mixing chamber, a first thermostatic element being disposed within said mixing chamber for controlling the proportions of heated and non-heated water that are mixed within said mixing chamber so that the temperature of the mixed water which is discharged from said mixing chamber does not exceed a predetermined upper temperature and whereby, upon increase of the temperature of the mixed water in the mixing chamber above the predetermined upper temperature, the first thermostatic valve is operable to substantially terminate the flow of water through said discharge outlet, said liquid mixing valve further including a safety valve which includes an inlet in communication with said discharge outlet, an outlet, and a flow passage for liquid therebetween, a second thermostatic element disposed in the flow passage and reactable to expand or contract relative to the temperature of liquid flowing past it, a shut off device which is movable with expansion or contraction of the second thermostatic element, the second thermostatic element being operable to shift the shut off device to a shut off position to substantially terminate flow of liquid through the outlet of the safety valve upon failure of the first thermostatic element to substantially terminate flow of water through the discharge outlet when the temperature of the water in the mixing chamber exceeds the predetermined temperature.